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MTR-266

A COST DATA RESEARCH PROGRAM PROPOSAL WITH SPECIAL EMPHASIS ON A TECHNICAL CHARACTERISTICS DICTIONARY

MARCH 1967

M. V. Jones

Prepared for
COMPTROLLER OFFICE
COST ANALYSIS DIVISION
ELECTRONIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
L. G. Hanscom Field, Bedford, Massachusetts

Project 1820
Prepared by
THE MITRE CORPORATION
Bedford, Massachusetts
Contract AF19(628)-5165

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FOREWORD

The writer is greatly indebted to the ESD Cost Analysis Division (R. Fuller and R. Schiazza) and to the MITRE System Analysis Department (F. A'Hearn, J. Cappelletti, S. Lewis, E. Runnells) for reviewing the preliminary drafts of this report. The preliminary draft also benefitted much from a review by the Project Forecast Cost Panel Membership.

REVIEW AND APPROVAL

This technical report has been reviewed and is approved.

ROBERT P. SCHIAZZA
Supervisory Cost Estimator
Cost Analysis Division
Comptroller

ABSTRACT

This report describes a comprehensive program of cost data research proposed for improving the credibility and accuracy of future cost estimates for Air Force Systems.

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SECTION I

INTRODUCTION

RELATION TO THE AFSC L-173 SERIES

The AFSC 173 Letter Series established a new set of costing procedures to aid the Command in managing the time and cost required to obtain technically acceptable weapon and support systems. AFSC L 173-1 established uniform procedures for deriving credible, accurate cost estimates. AFSC L 173-2 provided procedures for collecting cost and cost-related technical data in a standardized, integrated fashion from industrial contractors. AFSC L 173-3 provided procedures for comparing meaningfully different cost, performance, and schedule estimates from one time period to another.

This report proposes a comprehensive program of cost data research. This program would analyze and restructure the raw data collected under the 173-2 and 173-3 Letters and make these data available in form suitable for applying the estimating methods prescribed in 173-1 to derive the future cost estimates for specific systems.

The proposed program recognizes that cost estimators use numerous methods to make cost estimates and that they need a different type of data for each method. For this reason this program proposes that data research proceed along multiple lines, rather than in any single direction, so that the data base for all estimating methods will be improved.

THE FIVE BASIC ESTIMATING METHODS

Certain basic similarities underlying all estimating methods provide a conceptual structure around which a comprehensive program of Cost Data Research (CDR) can be developed. First, all estimating methods use historical cost experience, in one fashion or another, as a base for future cost estimates. Second, although historical cost experience may be analyzed in many different ways, all estimating methods can be classified into five basic types. These similar methodologies apply to all major product lines or systems (aircraft, missiles, space, and electronics) and also to all types of items (equipment, buildings, or personnel) within any given system or program. The five basic estimating methods are discussed below.

Catalogues

Much useful cost information, classified by type of item, has been collected into catalogues or compendiums. For example, many manufacturers publish their prices for standard, off-the-shelf equipment in available catalogues. Electronic data processing equipment is a good example. Also, certain military, non-profit, and private organizations publish catalogues listing prices of equipments of many different manufacturers. Aircraft and communications equipment are examples. Similarly, official and private compendiums provide standard per unit planning factors for non-equipment items. For example, construction cost reference books give the cost per square foot for hundreds of types of standard construction work. Thus, when the cost estimator can identify by model or specification the item to be costed, he can often secure the cost estimate he needs directly from a catalogue.

Specific Analogy

Frequently, a cost estimator uses the contract or estimated cost of an item of some single, prior system as a basis for estimating the future cost of a like item of a new system. In searching for a suitable analagous item, the estimator will usually compare the old and new item in terms of their performance or design characteristics such as the speed or weight of an aircraft or the storage capacity of a computer. This method is particularly appropriate when the new system will use the identical type of equipment that the old system used, and when there are good data on contract cost actuals for the old system.

Parametric Estimating Relationships

Sometimes a cost analyst uses parametric equations to estimate an item's cost. These equations, statistically derived from multiple historical observations, express an item's cost as a function of one or several performance, design, or operational characteristics of that item. For example, the cost of a booster in a new system may be estimated as a function of the thrust of the booster. The parametric equation estimating method differs from the specific analogy method in the following ways:

Parametric Equations	Specific Analogy
Based on multiple observations	Frequently based on a single analogy
The relationship is quantified by formal statistical analysis	The relationship is often qualitative and inferred intuitively
The equations are frequently derived by cost methodologists working independently and in a different time period than the estimator who subsequently uses them	The analogies are usually drawn by the cost estimator, himself, in the process of making a specific cost estimate

"Rule of Thumb" Factors

For many items that the estimator must cost there are no documented references, e.g., no catalogue records and no parametric equations. This is particularly true in the operating and development cost areas. In these cases estimators have come to rely on rule-of-thumb factors that express one type of cost as a simple percentage of another known type of cost. For example, in conceptual studies, costs of annual equipment spare parts are sometimes estimated as a percent of equipment procurement costs. Historically 25 to 50 percent of a typical system's total costs have been estimated by such rule-of-thumb factors.

Expert Sources

Sometimes a cost estimator is not in a position to use any of the four methods described above. Instead the estimator receives the estimate he needs directly from an organization or individual whose job responsibility requires him to be informed on particular types of costs. For example, an AFSC cost estimator may obtain an estimate of the training costs of a new system from the Air Training Command (ATC) or of the construction costs from the Army Engineer (AE). Of course, ATC or AE will probably use one or several of the first four methods cited as a basis for its estimate.

In practice, the choice of estimating methods will depend upon, at least, four major considerations: the type and quantity of information available describing the system or item to be costed; the type and quantity of cost and cost-related technical data available on analogous systems and items that may be used as an estimating base; the relative need for accuracy in the completed cost estimate as affected by the type of management decision to be made; and the time and resources available to do the estimating job. Where-

ever possible, it is preferable to combine several of the basic estimating methods in costing any item, because rarely are the available data for using any one method sufficiently complete or accurate.[1]

[1] A more extensive discussion of criteria for selecting a particular estimating method may be found in: AFSC L 173-1 (Cost Estimating Procedures), Chapter 6, and also in ESD-TR-65-396, "Estimating Methods and Data Sources in Costing Military Systems," M. V. Jones, December 1965.

SECTION II

MAJOR FEATURES OF A COST DATA RESEARCH PROGRAM

Because all of the five basic estimating methods are commonly used, cost data research should proceed in each of the following areas.

Catalogues

The number of cost and technical characteristics catalogues prepared on a major-item basis should be substantially increased. Also, the quality of the data reported in existing catalogues should be improved and such catalogues should be updated more frequently. Attachment 5 of AFSC L 173-1 lists approximately 50 different catalogues and compendiums useful in costing Air Force items. However, the item coverage of currently available catalogues is very uneven. Some items, such as EDP equipment, are thoroughly covered in three or four different catalogues both on costs and cost-related technical characteristics. Other items are not covered at all. Also, some items, such as aircraft, are much more intensively catalogued on technical characteristics than on costs.

System Data

A second major area of research should aim to establish a much better program for consolidating, indexing, and expeditiously retrieving historical data on individual systems. This program would draw upon the new AFSC cost-tracking system and upon recent changes in OSD and Air Force contractor reporting requirements. At present the information summaries on the item costs of individual systems or programs are both uneven and non-standardized. There is relatively good coverage in certain areas;

NORAD COST FACTORS, published annually, provides item-by-item cost breakouts for systems coming under NORAD's responsibility. The Defense Materials Services, a private publication, provides standard descriptive summaries on the major features of most current military systems; however, this source provides relatively few cost data. Actually, except for the highly aggregated Force Structure and Financial Plan, there is no document that ties together the item-by-item costs for all Air Force systems with meaningful descriptions of the items to which these costs apply.

Parametric Equations

A third area of research should aim to develop new and better parametric equations for both hardware and non-equipment items and for development and operating costs, as well as investment costs. Currently available ERs, mostly on equipment items, suffer from basic data problems; observations are too few, insufficiently homogenous, and of questionable validity. These ERs should be updated as the basic data supply improves both quantitatively and qualitatively under the AFSC Cost Information System. This ER development work should also cover non-financial estimating relationships as well as financial (i. e. , cost) relationships since the cost estimator often finds such non-financial relationships useful in completing the description of the system he will cost. Many non-financial relationships already appear in such documents as USAF's Planning Factors (172-3). Section IV under "Long Term Program of Statistical Research" of this paper discusses in greater detail this ER development program.

Rule of Thumb Factors

A fourth major area of data research should investigate the large number of undocumented rule-of-thumb factors used in cost estimating. Eventually, these undocumented rule-of-thumb factors should be replaced with firmly documented, statistically derived estimating equations. Concurrent with this long-run program there should be a short-run program to verify or reject the present rule-of-thumb factors. This verification program should be based on strategically selected spot-check samples covering a few major systems. AFSC's efforts should be coordinated with that of other organizations working in this area such as USAF, ATC, AFLC, RAND, and MITRE.

Expert Sources

Two steps should be taken to make a recourse to expert opinion a more reliable, useful method of cost estimation. One, a "Who's Who" type of directory of the military costing profession should be compiled. This directory would list the personnel and organizational units of military, non-profit, and industrial organizations working in the costing field with an indication of their specialized cost estimating knowledge, indexed primarily by major product area. The Tri-Service Costing Group, the Project Forecast Cost Panel, the Joint Study Group on Resource Allocation Methodology, and the Cost/Effectiveness Panel of the Operations Research Society of America should be solicited in compiling this Directory. Expert opinion should also be mobilized to augment the Technical Characteristics Dictionary; this use is described in Section IV under "Consensus Statements".

SECTION III

ESTABLISHING COST DATA RESEARCH PRIORITIES

ITEM ANALYSIS

To ensure that time and personnel are used most effectively, the Cost Data Research Program (CDRP) should be introduced selectively on an item-by-item basis. * This means that a careful study should be undertaken to determine which of the hundreds of items that the Air Force costs should receive the first and major consideration in a CDRP. Criteria that should be considered in establishing CDRP priorities are listed below.

Magnitude - All other things being equal, it is more important to do CDR on large-cost items than on small-cost items since the potential pay-off for increasing the accuracy of estimated total system costs is greater for large-cost items.

Quality of Present Data Base - It is more important, other things being equal, to do CDR on items that presently lack good cost catalogues, good estimating equations, etc., than for items that presently have a relatively strong documented data base. New advances in technology, such as over-the-horizon radar, may also dictate the direction of CDR emphasis.

Level of Detail - Decisions relative to the Work Breakdown Structure level at which CDR is to be conducted should conform to the Work Breakdown Structure levels at which most cost estimation is done.

* The term "item" is defined in the broad sense used in AFSC L 173-1. Item means any Program Work Breakdown Structure item, and includes such non-equipment items as system testing and evaluation, system engineering/management, data, etc. as well as mission and related equipment items.

ESTIMATING METHOD ANALYSIS

The next step is to decide for each item the direction that CDR should take, i.e., better cost catalogues, better parametric equations, a new directory of knowledgeable people, etc. Prior experience should be a major criterion in making priority decisions; it is important to find out what estimating methods and what data sources have been most used and most useful in the past. Experienced cost estimators can provide this information. Whatever the criterion used for selecting the specific areas of CDR and whatever the nature of initial decisions, the allocation of CDR effort should be an iterative decision. Changing requirements plus feedback from initial CDR work should dictate periodic realignment in the program.

SECTION IV

THE TECHNICAL CHARACTERISTICS DICTIONARY

INTRODUCTION

The Technical Characteristics Dictionary (TCD) was established by the AFSC L-173 Letter Series, and is exhibited in rudimentary form as Attachment 4 of L 173-1 and as Attachment 3 of L 173-2. Subsequently, the AFSC Product Divisions plus several industrial and non-profit organizations augmented the initial L-173 TCD compilations.

Simply stated, the TCD is a matrix which lists the major cost and resource related performance, design, and operating characteristics of Program Work Breakdown Structure items which should be considered in deriving and analyzing the costs of these items. Table I illustrates the basic format of the TCD.

APPLICATIONS OF THE TCD

In several ways the TCD aids the basic estimating methods described in Section I and generally serves as an important phase of a CDRP to improve the accuracy of AFSC cost estimates.

Parametric Equations

The TCD provides a documented, comprehensive, systematically developed list of technical parameters from which the independent variables can be selected for use in developing new cost-estimating parametric equations. Section IV under "Long-Term Program of Statistical Research" discusses the steps in using the TCD for this purpose.

Table I

Technical Characteristics Dictionary

Major Subsystem	Subsystem	Lower Level Breakout	Characteristics	Units of Measure
Air Vehicle			Altitude Range Dry Weight etc.	Feet Nautical miles Pounds
	Airframe		AMPR Weight On-Site Weight etc.	Pounds Pounds
		Wing	Area Span Material etc.	$Feet^2$ Feet Type
etc.	etc.	etc.		

Specific Analogies

The TCD makes the Specific Analogy method of cost estimation easier. A historic problem in using the Specific Analogy method of estimation has been the difficulty in determining how much alike or different the supposedly analogous items are; it is not always clear in what respects a new and an old item should be compared. The TCD reduces the comparison problem in the following ways:

(a) The TCD tells the estimator on what bases he should compare the new and old items; it tells him what parametric values he should

seek. In so doing the TCD reduces the time the estimator takes to develop an item's description and to make the cost estimate.

(b) The TCD can facilitate communication between the cost estimator and those who subsequently review and use his estimate. Disagreements and misunderstandings between the estimator and reviewer should be reduced because both will be using the same guidelines (the TCD) relative to the parametric values suitable for analogy.

(c) The TCD promotes uniformity in the estimating methods used by different estimators. With a well-developed TCD available, when two estimators are confronted with similar circumstances there will be less chance that one estimator will give major consideration to a radar's range, while another estimator gives major consideration to the radar's operating frequency when, perhaps, both of them should give prime consideration to the radar's peak power.

(d) The TCD also facilitates the implementation of the AFSC Cost Information System (CIS) by providing an official list of non-cost parameters for which values should be recorded on future systems in the CIS.

Expert Source Estimation

A cost estimator is frequently at a loss as to how to approach an expert; the estimator may not know how best to describe the item to be costed, particularly in a Conceptual Study when system description information is hard to obtain. By providing an authoritative, carefully selected list of cost-related parameters, the TCD helps the estimator describe his requirement to the technical expert.

When several different technical experts are to be consulted, the TCD helps ensure that the cost estimator describes the item to be costed in the same manner to different experts.

The TCD tends to standardize the approach of different estimators to the same or different experts on a similar problem.

The standard approach helps an estimator reconcile any differences in opinions that he receives from different experts and to combine the expert-source and specific-analogy methods of estimation in making a given cost estimate.

Estimate Review

The TCD, if augmented as described in Section IV under "Long-Term Program of Statistical Research," will facilitate the process of estimate review, thus indirectly improve the credibility and accuracy of cost estimates. Often the offices reviewing a cost estimate on a large complex system have only a generalized knowledge relative to the characteristics of the specific equipment and related items included in the total system cost estimate. In the past it has sometimes been difficult for a reviewing office to know whether the parametric analogies used by the originating estimator were the appropriate ones. A well developed TCD can help the reviewing office make reasoned, systematized evaluations on an item-by-item basis of the estimating methodology employed, and provides an official point of reference for any questions to be discussed with the estimator pertaining to the estimating methodology.

SHORT-TERM TCD AUGMENTATION PROGRAM

Section IV under "Long-Term Program of Statistical Research" outlines the major features of a long-term program of statistical research

aimed at converting the present qualitative TCD information into new parametric ERs. Preliminary action on this program should begin immediately; however, for two reasons it will not be possible to develop a large number of usable ERs in the immediate future. First, in many cases the development of new, better ERs must await the collection of a larger quantity and a more reliable supply of data. This improvement in data is likely to come slowly. Second, apart from the collection of data, the process of deriving useful ERs is often slow and painstaking. Experience has shown that this derivation for a single item can consume many man-months or even man-years of effort rather than man-hours or man-days.

Since better – even slightly better – data are needed in the short run, there should be a program, concurrent with the long run parametric equation program, to refine the qualitative information presently contained in the TCD to make it more useful to cost estimators in the short-term future. This short-term program should tap the "expertise" that generated the parameter listings contained in the present TCD. In other words, an authoritative, personalized, relatively undocumented data base should temporarily be established to compensate for sparsely documented, quantitative data. In effect, this project would resemble the procedure followed in writing AFSC L 173-1. AFSC L 173-1 basically did not aim at developing new cost methods; it aimed at documenting the best of the current cost estimating practices and the currently known cost estimating principles throughout the Systems Command and its supporting contractors. Similarly, this short-term TCD refinement would consolidate and make as explicit as possible, without making new major statistical studies, all that is known about the parameters listed in the TCD.

The experts who generated the present TCD, including its recent addenda, should be asked to assist in accomplishing the seven actions discussed below.

Consolidation

The first action should be to consolidate, wherever necessary, the multiple TCD parametric listings generated by many organizations for each item into a single listing. In some cases (e. g. , airframes), the TCD list of parameters for a single item presently exceeds 50. Parameters pertaining to "storage capacity" for EDP equipment provide another example of duplication and overlap. One organization submitted the following: "storage capacity" and "capacity of peripheral storage;" another organization listed "core storage capacity," "storage type," and "core storage buffers (number)." Other organizations submitted still different "storage" parameters. The question to be resolved is: Should there be two, three, five, ten, etc. discrete parameters for EDP storage? This same type of question applies across the whole list of TCD submissions generated to date. It means that a substantial TCD consolidation task must be accomplished. This consolidation will frequently be tedious because the different military and private organizations that provided AFSC with TCD listings sometimes used different nomenclatures to identify either a given item or parameter.

Definition

A second step should be to derive standard explicit definitions for each item and each parameter listed in the TCD. None of the TCD submissions that AFSC received to date provided definitions for either the items or parameters listed. The AFSC L-173 Manuals generally provide definitions only for Work Breakdown Structure Level 4 items, which is one level higher than that at which most cost estimation is done, and one level higher than most TCD listings.

Expansion

The list of items presently covered by the TCD should be expanded. At the present time the TCD mainly covers selected equipment and equipment-related items. The TCD omits construction, operations and maintenance, military personnel, RDTE, and other items constituting roughly 70 percent of a typical system's total activity, life-cycle costs. Moreover, even within the equipment group, only a small percentage of all Work Breakdown Structure items are covered by the TCD. Presently, the TCD provides cost-related parameters for only slightly more than 50 of the approximately 1000 Work Breakdown Structure Levels 4, 5, and 6 items. In other words, the present TCD barely scratches the surface in the scope-of-items coverage required.

Workload Assessment

There should be an assessment of the total workload involved in raising the TCD to its ultimate configuration. A gross item count, as suggested above, is only part of the workload story because the search for cost-related parameters for many items can be accomplished concurrently. In this connection, coordinated research among the AFSC Product Divisions can save much duplicate effort since all Product Divisions have Data, System Engineering/Management, etc. costs. Even within a given Product Division, a single set of parameters might satisfy several item groups. For example, similar parameters might cover both Operational and Maintenance Trainers in the Command and Control area.

Priority

Equal time and effort for TCD augmentation should not be given to all Work Breakdown Structure items and parameters. The criteria suggested for establishing priorities for the total CDRP should also be considered in

establishing item priorities for TCD research. New TCD research should aim to develop parametric data for some important items not now included in the TCD. Moreover, even for the items now covered by the TCD (equipment items), the cost-related characteristics listed by the TCD have been primarily performance and design parameters. Future TCD work should seek to identify the important cost-related operating and program characteristics such as activity rates, manning concepts, and logistics support concepts.

Screening

The present TCD list of parameters should be screened to separate the important cost-related characteristics from less important ones. A shorter parameter list is preferred because it concentrates the cost estimator's valuable time in analyzing the important parameters. From the long-run objective of generating new formal, statistical relationships, screening is also necessary both to reduce the statistical calculation workload and to eliminate parameters not susceptible to quantitative analysis. Also, parameters should be deleted from the TCD lists whose values are not likely to be known in the early phase of a system's development. For example, the "number of component parts required" is not a very useful parameter for future cost estimating purposes. A parts count is unlikely to be known until a particular manufacturer's model of a required equipment item has been specified. However, when the equipment model has been specified, a catalogue or a prior contract price is likely to be available as a cost estimating base, and the parts count information is likely to be of little additional vlaue.

Consensus Statements

Wherever possible, a panel of experts on an item should be designated to write a statement briefly describing the group's consensus relative to the

relationship presumed to exist between the major parameters and the item's cost. Such panels should be composed of engineers having a good feel for future technological developments in the specified field, cost personnel who have estimated the costs for numerous similar items in prior systems, and cost methodologists who have experimented at developing ERs for the particular item in the past. If carefully drawn, these statements, distilling and pooling the insights of those best in a position to know, will provide useful guidance to the cost estimator until formal statistical analysis based on extensive data can be completed.

An illustrative, expert-consensus statement might read:

"CONSOLE TYPE DATA DISPLAY EQUIPMENT — Single character display rate (characters per second), brightness (foot-lamberts), and resolution requirements (lines per inch) are the major parameters affecting the procurement cost of console type display equipment. Past experience seems to indicate that, for units having resolution requirements exceeding 1,000 lines per inch, resolution requirements are roughly twice as important as the other two factors in affecting the equipment's cost. For units with less than 1,000 lines per inch resolution requirements, the three parameters are roughly of equal importance in affecting the equipment's cost."*

LONG-TERM PROGRAM OF STATISTICAL RESEARCH

Introduction

The long-term program for TCD augmentation would differ from the short-term program in the type of analysis emphasized, the scope of items

*The above statement is purely illustrative. Subsequent expert or statistical analyses may reveal that some other parameters (maximum scan rate, power requirements, etc.) are better predicators of cost than those cited.

covered, and the time horizon over which the work extends. The short-term program would be projected over a period of months or a year or two at the longest, would aim to achieve a modest improvement in the data base for a large number of items, and would rely heavily on a consensus of expert opinions. The long-run program, on the other hand, would extend over a period of three to five years, would aim to achieve a major improvement in the data base for a smaller group of important items, and would rely primarily upon formal statistical analysis. In the early period of the CDRP the short-term and long-term TCD augmentation programs would proceed concurrently.

Major Considerations

Preliminary Planning

Many of the features of the short-run program would also be essential to the long-run program, such as the consolidation and screening of parameters, and the definition of items and parameters. The choice of items subjected to statistical analysis would also be important. Although all Work Breakdown Structure items should eventually be subjected to formal statistical analysis, the priority of treatment and the intensiveness of the analysis should vary according to the criteria discussed in Section III.

Data Collection

The most challenging aspect of the long-run statistical analysis program would be the collection of the required data. Much of the existing historical data is of limited value because the number of observations is too small and the available item data lack clear and consistent definition from one system and time period to the next. Future ER development should be coordinated closely with both the Cost Information Reports (CIR) and the Cost Tracking (CT) System and, whenever possible, should seek contractor cost "actuals" as opposed merely to cost estimates.

Standardized Statistical Methods

Standard statistical guidance should be developed to apply to all AFSC product lines and to all items within each product line. Although this guidance would draw upon text-book statistical methods, it should be tailored expressly to fit AFSC ER derivation. The style of presentation should be simple and brief. In addition to covering conventional regression analysis, correlation analysis, and tests of significance, the guidance should provide direction on handling problems particularly troublesome in military ER development, such as extremely small and non-homogenous data samples.

Computerizing the Program

The statistical analysis work leading to the derivation of ERs should be computerized to reduce the manpower and time required to get results and to permit a continual up-date of results as new data are received from the CIR and CT systems.

SECTION V

IMPLEMENTATION

This paper aimed at discussing only the substantive issues of a CDRP, the what-should-be-done issues. The "whether," "when," "how much," and "by whom" issues are beyond the scope of this paper. For this reason there is only cursory mention of the implementation or administration of the program. However, several general statements relative to implementation should be noted:

(a) The extent to which the total CDRP could be implemented would depend importantly on how quickly the AFSC Divisions can increase their present cost estimating staff.

(b) It has been presumed that the total CDRP would be monitored by AFSC Headquarters with most of the daily details of the program carried on by the Product Divisions.

(c) Since the total CDRP would be quite comprehensive in scope, there would be advantages in coordinating AFSC research with that of other organizations, official and private, working to establish better cost information systems. Some of these other organizations are: OSD, USAF Hq., other Air Force Commands (ATC, AFLC, etc.), non-profit organizations, industrial contractors, private research-consulting firms, and professional associations such as the Project Forecast Cost Panel, the Tri-Service Costing Group, and the Joint Study Group on Resource Allocation Methodology.

(d) Close liaison with organizations and individuals responsible for the administration and modification of the new contractor reporting systems (CIR, CIS, CT, etc.) is indispensable.

(e) The long-run and short-run sectors of the CDRP must be reasonably balanced and compatible. In several cases it has been noted that a common-line of action will promote both programs.

(f) Considering the likelihood of personnel staffing constraints in the discernible future, it might be advantageous to introduce different phases of the CDRP selectively on a pilot-test basis in different Product Divisions rather than to establish the total system concurrently in all Product Divisions.

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